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**Unit 9, Part 3 Notes: Biogeochemical Cycles and Biomes**

Pre-AP Biology, Mrs. Krouse

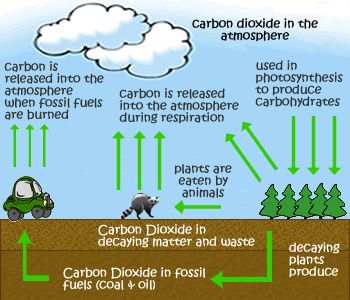
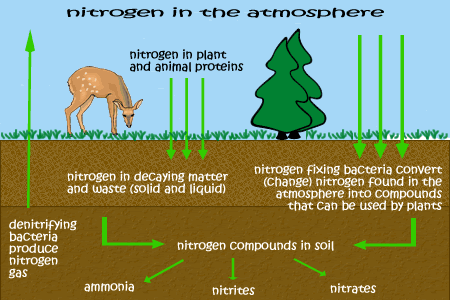
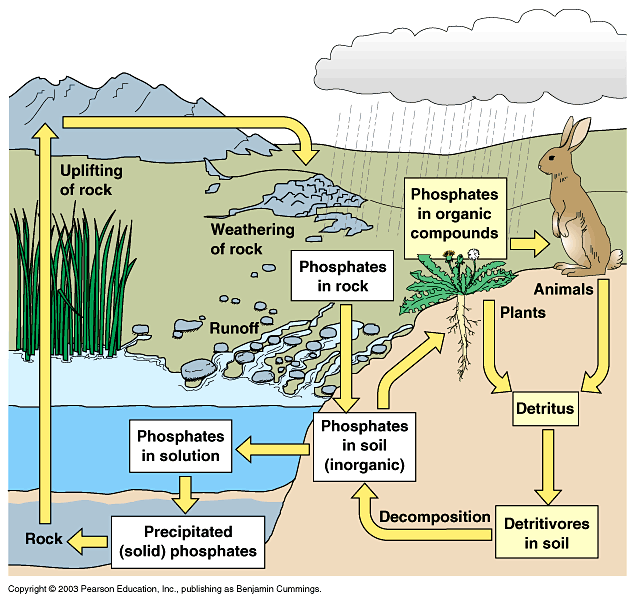
**Biogeochemical Cycles**

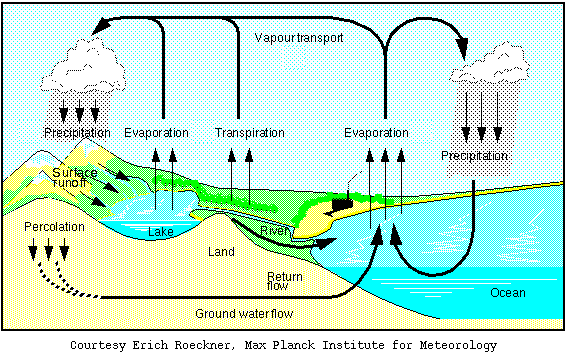
1. **Biogeochemical cycles** are the processes by which elements like carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur (remember CHNOPS?) and chemical compounds like water (H2O) are transferred between living organisms and the non-living components of their environment.

*Note: “Bio” means “life” and “geo” means “earth”, so these cycles involve living things, the non-living earth, and chemicals (i.e., elements and compounds).*

1. The cycles we will focus on are the water cycle, the carbon cycle, the nitrogen cycle, and the phosphorus cycle. The last three cycles in this list are called “**nutrient cycles**” because carbon, nitrogen, and phosphorus are essential to living organisms’ growth, development, and day-to-day life processes.

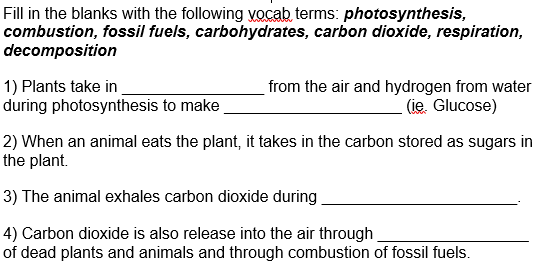
*Note: Oxygen is also part of the nutrient cycles because it forms chemical compounds with carbon, nitrogen, and phosphorus at various points in the biogeochemical cycles.*

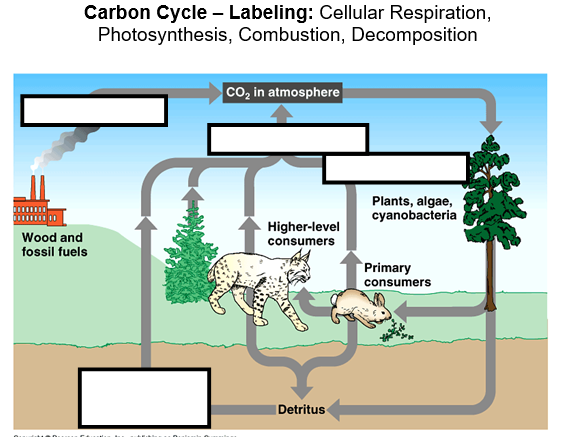
1. **The Carbon Cycle**
2. Where is carbon found in living and nonliving things?
3. **Living**: Carbon is found all four types of macromolecules—carbohydrates, lipids, proteins, and nucleic acids—that are found in the cells of living organisms.
4. **Nonliving:** Carbon is found in several types of rocks as **calcium carbonate** (CaCO3), and, it is also found in the atmosphere as carbon dioxide (CO2).
5. By what processes does carbon cycle throughout the biosphere?
6. **Photosynthesis**: Plants and other photosynthesizing organisms take in carbon dioxide from the atmosphere and convert it to glucose (C6H12O6).
7. Animals take in carbon by eating plants or animals that have eaten plants (or animals that have eaten animals that have eaten plants, etc.)
8. **Cellular Respiration:** All living organisms break down glucose to create ATP and release carbon dioxide back into the atmosphere.
9. **Decomposition:** Dead organisms break down and decay (often with the help of decomposers such as fungi and bacteria.) In this process, carbon is released into the air as carbon dioxide and into the soil. If decomposition of organisms occurs under pressure, coal and fossil fuels (which contain carbon) can form.
10. **Combustion of Plant Products and Fossil Fuels:** The burning of plant products (ex: wood) and fossil fuels releases carbon dioxide into the atmosphere.
11. Volcanic activity also releases carbon dioxide into the atmosphere.
12. **The Nitrogen Cycle**
13. Where is nitrogen found in living and nonliving things?
14. **Living:** Nitrogen is found in proteins and nucleic acids within living cells. Nitrogen compounds such as **ammonia** (NH3), **nitrate** (NO3-), and **nitrite** (NO2-) are found in animal wastes (ex: urine).
15. **Nonliving:** Nitrogen is found in the form of **nitrogen gas** (N2) in the atmosphere. In fact, nitrogen gas composes 78% of the Earth’s atmosphere.
16. By what processes does nitrogen cycle through the biosphere?
17. Certain types of bacteria can take in nitrogen gas and convert it to nitrogen found in the soil (ex: ammonia, nitrate, and nitrite). These bacteria are found on the roots of plants called legumes (ex: beans, peas, and clover) and in the soil. This process is called **bacterial nitrogen fixation**. Lightning an also be used to “fix nitrogen.” This is called **atmospheric nitrogen fixation.**
18. Nitrogen can enter the soil when dead organisms decompose.
19. Plants can take in nitrogen found in the soil through their roots.
20. Animals can take in nitrogen when they consume other organisms.
21. Other types of soil bacteria can take in soil nitrogen and convert it to nitrogen gas. This process is called **denitrification.**
22. **The Phosphorus Cycle**
23. Where is phosphorus found in living and nonliving things?
24. **Living:** Phosphorus is found in the phosphate groups of DNA and RNA, which are both nucleic acids. Phosphorus is also found in the hydrophilic heads of phospholipid molecules, which make up the cell membrane.
25. **Nonliving:** Phosphorus is found in the form of inorganic phosphate (PO43-) in rocks, the soil, and bodies of water. “Inorganic” means that the phosphate is not part of a larger, carbon-containing biological molecule. Unlike carbon and nitrogen, phosphorus is NOT found in the atmosphere.
26. By what processes does phosphorus cycle through the biosphere?
27. When exposed to rain, wind, etc., rocks containing phosphorus begin to break down/erode. This is called **weathering**. By this process, phosphorus enters the soil or enters bodies of water via **runoff** (i.e., the draining away of water and substances carried in it from the surface of an area of land).
28. Phosphorus can also enter the soil through decomposition of dead organisms.
29. When phosphorus enters bodies of water, it can become part of sediment (i.e., sand) and form rock through the process of **sedimentation.**
30. Plants can take in soil phosphorus through their roots.
31. Animals take in phosphorus by consuming other organisms.
32. **The Water Cycle**
33. Where is water found in living and nonliving things?
34. **Living:** Water makes up 70% or more of the mass of living cells.
35. **Nonliving:** Water is found in its liquid state oceans, lakes, rivers, etc. Liquid water is also found in the soil. Water is found in its gaseous state (**water vapor**) in the atmosphere. Water is also found in its solid state (ice) in cold areas.
36. By what processes does water cycle through the biosphere?
37. Energy from the sun causes water to evaporate off the surface of bodies of water and the bodies of living organisms. During **evaporation,** water converts from its liquid state to its gaseous state (water vapor) and enters the atmosphere. Evaporation that occurs out of little holes on the bottom of plant leaves (stomata) is called **transpiration**. Evaporation that occurs off the surface of our skin is called sweating!
38. Due to cooling in the cloud layer, water vapor converts back into liquid water. This is called **condensation.**
39. After condensation, water can fall to the ground as rain. This is called **precipitation.**
40. Rain can seep/soak into the soil, which is called **percolation.** Once water is in the soil, it is considered **groundwater.**
41. Leftover precipitation that cannot percolate into the soil may drain into a body of water (ex: a stream or pond). This is called **runoff.**
42. Plants take in groundwater through their roots.
43. Animals take in water by drinking it directly from bodies of water or by consuming other organisms.
44. Animals return water to the soil through their waste products (ex: urine).



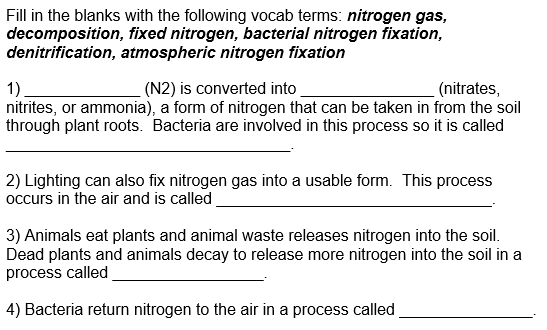
***Practice Question #1:*** Fill in the blanks for each of the statements about the carbon cycle, the nitrogen cycle, the phosphorus cycle, and the water cycle with the correct terms. Then, fill in the boxes in the associated diagrams with the correct terms.

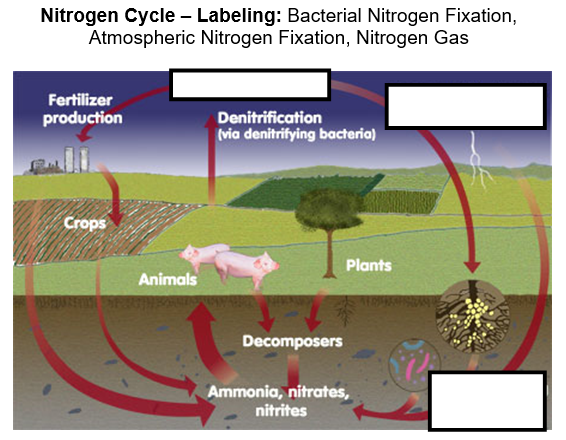
1. **The Carbon Cycle**



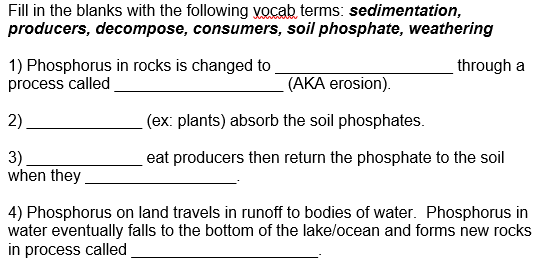


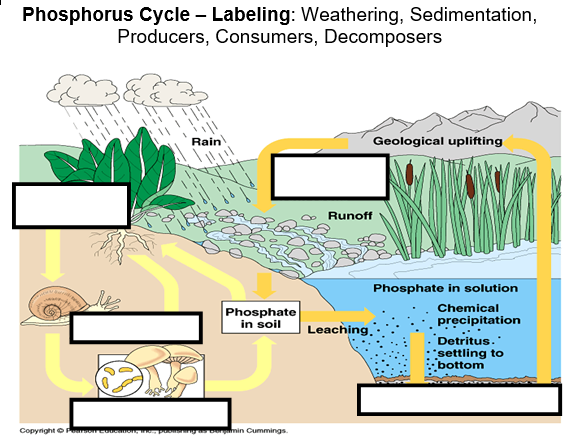
1. **The Nitrogen Cycle**



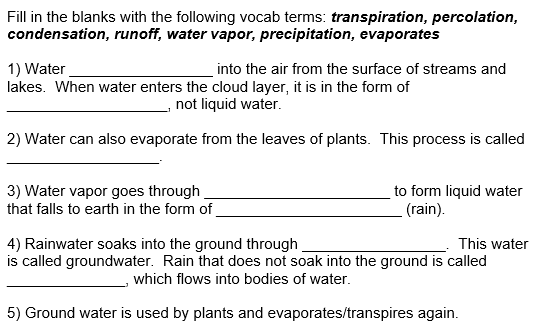


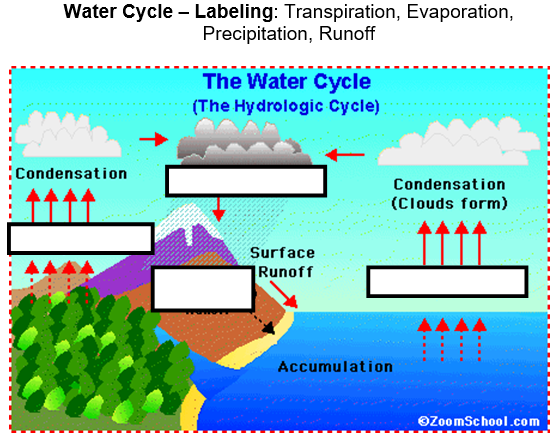
1. **The Phosphorus Cycle**





1. **The Water Cycle**



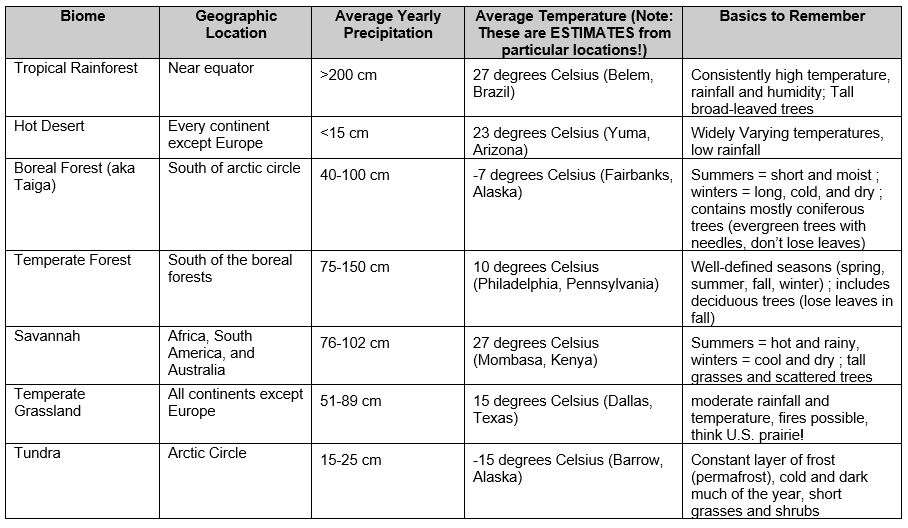


***Practice Question #2:*** Answer each of the following questions about the biogeochemical cycles.

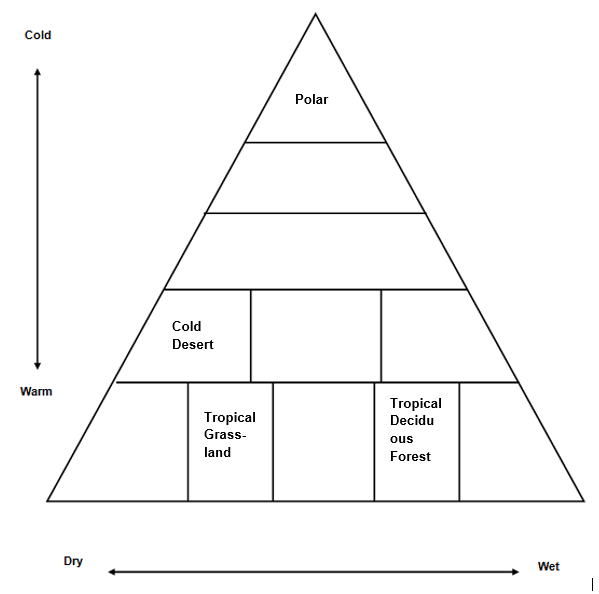
1. How would the amount of carbon dioxide in the air be affected if decomposers could not perform their role in the carbon cycle? Explain your answer.
2. What process removes carbon dioxide from the atmosphere?
3. How would the amount of phosphorus taken in by plants be affected if there were decreased rates of erosion/weathering in a particular year? Explain your answer.
4. What is the name of the process that returns nitrogen to the air from the soil?

**Biomes:**

1. A **biome** consists of a group of ecosystems that have similar dominant species and the same climate. A dominant species is a species with a high abundance within an ecosystem. Examples of terrestrial (land) and aquatic (water) biomes are given in the charts on the next page with key information about each biome. You do NOT need to know specific information about biomes OTHER THAN what is required to answer Practice Questions 3 and 4.
2. Terrestrial biomes are often distinguished from one another based on their dominant producer (plant) species, precipitation rates, and temperature.

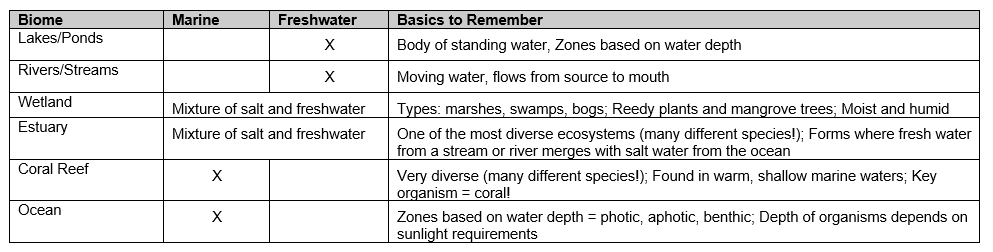


***Practice Question #3:*** Fill in the missing terrestrial biomes to the pyramid diagram given below based on their average yearly precipitation and average temperature.



1. Aquatic biomes are often distinguished from one another based on their dominant species, the depth of the water, flow of the water, salinity of the water, temperature, etc.

*Note: Marine means salt water!*



***Practice Question #4:*** Place the letter associated with each biome name listed in the word bank next to the correct description of the biome.

